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TITLE : MEDIUM CARBON TOUGH AND HARD STEEL

ABSTRACT : PURPOSE: To ensure strength and toughness equal to or higher than those of the conventional tempered material in an as-hot-forged state, e.g., by specifying respective contents of oxide-forming elements, such as Ti and Zr, in a medium carbon steel and incorporating the grains of oxide and composite body of oxide and MnS having a specific grain size.

CONSTITUTION: A medium carbon tough and hard steel has a composition consisting of, by weight ratio, 0.10-0.60% C, 0.01-3.00% Si, 0.20-3.00% Mn, 0.01-0.30% S, 0.03-0.30% V, 0.005-0.060% N, further one or more kinds among 0.001-0.100% Ti, 0.001-0.100% Zr, 0.001-0.200% Hf, 0.001-0.150% Y, 0.001-0.150% La, 0.001-0.150% Ce, 0.001-0.050% Ca, and 0.001-0.010% Mg, and the balance Fe with inevitable impurities. Further, the grains of oxide and composite body of oxide and MnS of 0.1-10 μ m grain size are incorporated by 1 \times 10³ to 1 \times 10⁶ pieces/mm³.

Moreover, the contents of Al and P are limited to \leq 0.005% and \geq 0.03%, respectively. By this method, a steel having superior strength and toughness in an as-hot-forged state can be obtained while obviating the necessity of tempering treatment.

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